


(a) a dicarboxylic acid functionalized material selected from the group consisting of dicarboxylic acid-functionalized polymers of polyethylene, polyisoprene, poly(isobutylene), poly(butadiene-co-styrene), poly(butadiene-co-acrylonitrile-co-acrylic acid), poly(ethyl acrylate), poly(ethyl acrylate-co-n-butyl acrylate), poly(n-butyl acrylate-co-acrylonitrile), poly(butyl acrylate-co-styrene), and combinations thereof, with

(b) an hydroxyalkylating reagent selected from the group consisting of carbocyclic carbonates, carbocyclic sulfites, and combinations thereof, in the presence of

(c) a phase transfer catalyst under conditions sufficient to form said dihydroxyl-functionalized material.


~~42~~⁴¹ 20. The process according to claim ~~19~~⁴¹, wherein said dihydroxyl-functionalized material is selected from the group consisting of dihydroxyl-functionalized polymers of polyethylene, polyisoprene, poly(isobutylene), poly-(butadiene-co-styrene), poly(butadiene-co-acrylonitrile-co-acrylic acid), poly(ethyl acrylate), poly(ethyl acrylate-co-n-butyl acrylate), poly(n-butyl acrylate-co-acrylonitrile), poly(butyl acrylate-co-styrene), and combinations thereof.

REMARKS

Prior to amendment, this application contained claims 1-20. Claims 1-20 have now been cancelled. New claims 1 to 20 have been added. This application now has claims 1-20. Attached hereto is a marked-up version of the changes made to the claims by the current amendments. The attached pages are captioned "**Version with Markings to Show Changes Made.**" No new matter has been introduced by the new claims.

The new claim 1 has been added the define that which Applicants consider to be the present invention. Support for the new claim 1 is found in cancelled claims 1 and 2, on page 6, lines 22 to 25, on pages 9 to 10 and pages 15 to 16, of the specification. New claim 1 further defines that the dihydroxyl-functionalized material has a molecular

weight not more than about three times greater than the molecular weight of the starting material, which is the dicarboxylic acid-functionalized material. Support for the dihydroxyl-functionalized material having a molecular weight not more than about three times greater than the molecular weight of the dicarboxylic acid-functionalized material is in Examples 1, 2 and 10 of the present specification. For example, Example 10 states that the molecular weight of HTBN prepared according to Example 1, using CTBN with a molecular weight of 3,800, was found to be 10,400. Example 10 further states that the molecular weight of HTBN prepared according to Example 2, using CTBN with a molecular weight of 3,800, was found to be 11,300. Thus the molecular weight of the HTBN of Example 1 is 2.73 times (i.e., about 2.7 times) the molecular weight of CTBN. Similarly, the molecular weight of the HTBN of Example 2 is 2.97 times (i.e., about 3.0 times) the molecular weight of CTBN. Therefore, the description in the new claim 1 that the dihydroxyl-functionalized material has "a molecular weight not more than about three times greater than the molecular weight of the dicarboxylic acid-functionalized material" is fully supported by the specification.

New claim 2 has been added to define the carboxyl-functional end groups of the dicarboxylic acid-functionalized material. Support for this new claim is found in cancelled claim 1, on pages 9 to 10 and pages 15 to 16, of the specification.

New claim 3 has been added to define the molecular weight of the dicarboxylic acid-functionalized material. Support for this new claim is found in the cancelled claim 1 and page 10, lines 30 to 36.

New claim 14 recites a hydroxyalkylating reagent to dicarboxylic acid-functionalized material molar ratio of from about 3.8 to about 4.5. Support for this ratio is found in examples 1, 2, 6, 7 and 8: example 1 with a ratio of 4.1, example 2 with a ratio of 4.5, example 6 with a ratio of 3.8, example 7 with a ratio of 4.4 and example 8 with a ratio of 4.2. Accordingly, a molar ratio of from about 3.8 to about 4.5 is fully supported by the specification.

Applicants acknowledge the Examiner's statement in the Advisory Action dated May 1, 2001, that the amendments made in the Applicants' April 23, 2001 Response to the Final Action regarding the prior application would have overcome the objection to new matter, the corresponding rejection under 35 U.S.C. § 112, first paragraph, and the rejections under 35 U.S.C. § 112, second paragraph, if entered. Amendments made in the Response to the Final Action have been incorporated into the new claims.

The claims of the prior application had been rejected under 35 U.S.C. § 103 (a) as being allegedly obvious over U.S. Patent No. 4,444,692 to Okamoto (hereafter Okamoto) in view of Examiner's Notice, in further view of U.S. Patent No. 4,266,046 to Wu (hereafter Wu) or "Synthetic Studies with Carbonates. Part 6. Syntheses of 2-Hydroxyethyl Derivatives by Reactions of Ethylene Carbonate with carboxylic Acids or Heterocycles in the Presence of Tetraethylammonium Halides or under Autocatalytic Conditions", J.C.S. Perkin I, 1266-72 (1977) by Yoshino (hereafter Yoshino).

Okamoto describes a process for preparing a hydroxyl-terminated polymer using: (a) ethylene oxide; and (b) a tertiary amine catalyst. The Examiner's Notice was that since ethylene oxide is a hazardous material, it would be undesirable to use it as a reactant. Wu describes a process for preparing polyesters of polycarboxylic acids using a cyclic carbonate with a monomeric polyfunctional carboxylic acid in the presence of an alkylammonium halide catalyst. Yoshino describes preparation of a mixture of mono- and di-esters of ethylene glycol with a mono-carboxylic acid by the reaction of a monocarboxylic acid with ethylene carbonate in the presence of an alkylammonium halide catalyst. The 35 U.S.C. § 103 (a) rejection was based on Okamoto in view of Examiner's Notice and further in view of Wu or Yoshino.

Applicants repeat arguments made in the prior Response and state the following:

(1) nearly all chemicals used in the chemical industry, including ethylene oxide, are toxic to one degree or another to humans, animals and the environment and despite this, millions of pounds of ethylene oxide are produced annually by the chemical industry. A person of ordinary skill in the art would not be motivated to look for a

replacement for ethylene oxide simply because it might be hazardous. The mere fact that a chemical is hazardous is not, in and of itself, a suggestion to replace ethylene oxide with another chemical because ethylene oxide is an inexpensive hydroxyalkylating agent. The “added cost to provide the necessary safety and protection” argument forwarded by the Examiner is not persuasive because ethylene oxide is so inexpensive that safety costs would not be sufficient to offset the higher cost of alternative reagents. Accordingly, Applicants respectfully point out that the Examiner’s Notice does not provide the necessary motivation to look for alternatives or to combine Okamoto with Wu or Yoshino; and

(2) a person of ordinary skill in the art would have to be further motivated to look for a replacement for the “tertiary amine catalyst.” The Examiner states that “one of ordinary skill in the art would know to use the catalyst taught by the secondary references for the reaction of the carboxylic acid groups with ethylene carbonate, not the catalysts taught by Okamoto for the reaction of the reaction of carboxylic acid groups with ethylene oxide.” Applicants strongly disagree with this statement, which assumes that one of ordinary skill in the art would instinctively know how to pick and choose the right ingredients from one reference and simultaneously pick and choose the right ingredients from another reference to come up with the exact combination of ingredients to produce all the elements of the instant process. There is no suggestion in Okamoto to replace the basic tertiary amine catalyst with a neutral phase transfer catalyst. There is no suggestion in either Wu or Yoshino that phase transfer catalysts and tertiary amine catalyst are equivalent or interchangeable. There is no suggestion in any of the references that the basic tertiary amine catalyst can be replaced with a neutral phase transfer catalyst, or *vice versa*, and obtain the same result. Thus, Okamoto and Wu or Yoshino are not combinable.

As mentioned in the Applicants’ Response to the Final Action, controlling the molecular weight of the hydroxyalkylated final product is critical for producing a useful hydroxyalkylated final product. The Examiner has stated in the Advisory Action that “controlling the molecular weight of the hydroxyalkylated final product is critical is not

deemed to be persuasive because this is not a limitation in the claims which have been examined." The newly presented claim 1 specifically recites that the dihydroxyl-functionalized material has "a molecular weight not more than about three times greater than the molecular weight of the dicarboxylic acid-functionalized material." Because of this characteristic of the present process, the present invention avoids extensive resin extension. The absence of excessive resin extension in the dihydroxyl-functionalized material is an important requirement because low fusible-materials and block prepolymer resins prepared from HTBNs and organic diisocyanates are constrained by the permissible molecular weights of the reactants to achieve appropriate physical properties in the final product. High molecular weight materials would not be useful in the compositions of the present invention.

It is respectfully submitted that all claims are allowable for at least the reasons stated. An early indication of their allowability by issuance of a Notice of Allowability is earnestly solicited.

Respectfully submitted,

Date: June 6, 2001

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please cancel all pending claims without prejudice.

Please add the following new claims:

- 1. A process for preparing a dihydroxyl-functionalized material by hydroxyalkylating a dicarboxylic acid-functionalized material, said process comprising the step of: reacting as reactants: (a) a dicarboxylic acid-functionalized material selected from the group consisting of dicarboxylic acid-functionalized polymers of: polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) and combinations thereof; and (b) a hydroxyalkylating reagent selected from the group consisting of: a carbocyclic carbonate and a carbocyclic sulfite; in the presence of: (c) a phase transfer catalyst under conditions sufficient to form a dihydroxyl-functionalized material having a molecular weight not more than about three times greater than the molecular weight of said dicarboxylic acid-functionalized material.
2. The process according to claim 1, wherein said dicarboxylic acid-functionalized material has carboxyl-functional groups independently selected from the group consisting of: R and R¹, wherein each R and R¹ is independently selected from the group consisting of: COOH or CAA¹-X-COOH, wherein each A and A¹ is independently selected from the group consisting of: hydrogen, halogen, cyano, linear or branched alkyl having from 1 to about 5 carbon atoms and wherein X is a linear or branched alkyl having from 1 to about 5 carbon atoms.
3. The process according to claim 1, wherein said dicarboxylic acid-functionalized material has a molecular weight of from about 3,100 to about 4,200.
4. The process according to claim 1, wherein said hydroxyalkylating reactant

is a member selected from the group consisting of carbocyclic carbonate, carbocyclic sulfites and combinations thereof.

5. The process according to claim 4, wherein said carbocyclic carbonate is a member selected from the group consisting of ethylene carbonate, 1,3-propylene carbonate, 2-methyl-1,2-ethylene carbonate, 3-methyl-1,3-propylene carbonate, 1,2-dimethyl ethylene carbonate, 2,2-dimethyl butylene carbonate and combinations thereof.

6. The process according to claim 4, wherein said carbocyclic carbonate is ethylene carbonate.

7. The process according to claim 4, wherein said carbocyclic sulfite is a member selected from the group consisting of ethylene sulfite, propylene sulfites and combinations thereof.

8. The process according to claim 4, wherein said carbocyclic sulfite is ethylene sulfite.

9. The process according to claim 1, wherein said dihydroxyl-functionalized material is selected from the group consisting of the dihydroxyl-functionalized polymers of: polybutadiene, poly(butadiene-co-acrylonitrile), polyacrylonitrile, and combinations thereof.

10. The process according to claim 1, further comprising the step of providing an amphoteric treating agent in an amount sufficient to cause said dihydroxyl-functionalized material to separate from the reactants which remain and/or any by-products thereof.

11. The process according to claim 10, wherein said amphoteric treating agent is a member selected from the group consisting of silicated magnesium oxide,

magnesium oxide, magnesium hydroxide, calcium hydroxide, barium hydroxide and combinations thereof.

12. The process according to claim 1, wherein said phase transfer catalyst is a member selected from the group consisting of quaternary ammonium halides, phosphonium halides, sulfonium halides, crown ethers, calixarenes and combinations thereof.

13. The process according to claim 1, wherein said phase transfer catalyst is a member selected from the group consisting of tetrabutyl ammonium iodide, tetraethyl ammonium iodide, benzyl trimethyl ammonium chloride and ethyl triphenylphosphonium bromide.

14. The process according to claim 1, wherein the molar ratio of said hydroxyalkylating reagent to said dicarboxylic acid-functionalized material is from about 3.8 to about 4.5.

15. The process according to claim 1, wherein said carboxylic acid-functionalized material is a member selected from the group consisting of carboxylic acid-functionalized polybutadiene and carboxylic acid-functionalized poly(butadiene-co-acrylonitrile) .

16. A dihydroxyl-functionalized material prepared by the process of claim 1.

17. An adhesive, coating or sealant composition having improved toughness and elongation properties and curable through a gap of more than 40 mils, said composition comprising (a) a reaction product of (i) the dihydroxyl-functionalized material according to claim 1, and (ii) a molar excess of a reaction product of a molar excess of an aromatic or cycloaliphatic polyisocyanate and a compound selected from the group consisting of an aromatic or cycloaliphatic polyol, the reaction product of (i) and (ii) subsequently being reacted with a molar excess of a compound selected form

the group consisting of a hydroxyalkyl acrylate, a hydroxyalkyl methacrylate, an amino alkyl acrylate, an amino alkyl methacrylate and combinations thereof; and (b) an initiator selected from the group consisting of free radical initiators and photo-initiators.

18. The composition according to claim 17, wherein said polyisocyanate is a member selected from the group consisting of toluene diisocyanate and 4,4'-diisocyanate diphenyl methane; and the reaction product in (a) is an isocyanate-terminated hydrogenated bisphenol-A and toluene diisocyanate.

19. A process for preparing a dihydroxyl-functionalized material by hydroxyalkylating a dicarboxylic acid-functionalized material, said process comprising the step of: reacting as reactants

(a) a dicarboxylic acid functionalized material selected from the group consisting of dicarboxylic acid-functionalized polymers of polyethylene, polyisoprene, poly(isobutylene), poly(butadiene-co-styrene), poly(butadiene-co-acrylonitrile-co-acrylic acid), poly(ethyl acrylate), poly(ethyl acrylate-co-n-butyl acrylate), poly(n-butyl acrylate-co-acrylonitrile), poly(butyl acrylate-co-styrene), and combinations thereof, with

(b) an hydroxyalkylating reagent selected from the group consisting of carbocyclic carbonates, carbocyclic sulfites, and combinations thereof, in the presence of

(c) a phase transfer catalyst under conditions sufficient to form said dihydroxyl-functionalized material.

20. The process according to claim 19, wherein said dihydroxyl-functionalized material is selected from the group consisting of dihydroxyl-functionalized polymers of polyethylene, polyisoprene, poly(isobutylene), poly-(butadiene-co-styrene), poly(butadiene-co-acrylonitrile-co-acrylic acid), poly(ethyl acrylate), poly(ethyl acrylate-co-n-butyl acrylate), poly(n-butyl acrylate-co-acrylonitrile), poly(butyl acrylate-co-styrene), and combinations thereof. --